HRT2241-Plant propagation

Study Guide to Chapter 1 Evolution of Plant Propagation in Human Society

Compulsory reading: Page 2-15 in Hartman and Kester, (2018)

Learning Objectives

- Describe the evolution of plant propagation during human history.
- Describe aspects of modern plant propagation activities.

1. Introduction

- Plant propagation is considered a foundational occupation of humankind, marking the transition to civilization and increased human control over the environment.
- Agriculture originated approximately 10,000 years ago.
- Early societies shifted from nomadic hunting and gathering to settled life.
- The ability to cultivate plants and domesticate animals allowed for stable, permanent communities, which eventually evolved into cities and nations.
- Humans selectively propagated plants to ensure a more reliable and convenient food supply and to provide resources for themselves and their livestock.

2. The Five Fundamental Activities of Agriculture

Agriculture is defined as the deliberate cultivation of crops and animals for human use, encompassing these five key areas:

1. **Plant Selection:** The process of choosing and developing specific plant varieties.
2. **Plant Propagation:** Multiplying plants while ensuring the preservation of their unique qualities.
3. **Crop Production:** Cultivating plants under controlled conditions to achieve maximum yields.
4. **Crop Handling & Storage:** Preserving harvested products for long-term use and efficient transport.
5. **Food Technology:** Transforming and preserving crop products for various uses (e.g., milling grain for bread, pressing oil, fermentation for wine, or dehydration).

3. Stages of agricultural development

a. Hunting and Gathering

- Human communities began to select, breed, domesticate and cultivate various species of plants and animals about 10,000 years ago.
- The beginning of agriculture, sometimes called the **Neolithic or agricultural revolution**, initiated the gradual change from a lifestyle of hunting and gathering into stable communities.
- Propagation arose from the need to select and maintain those plants that provided a greater and more desirable supply of food and other useful plant products for human needs.

Symbiotic Relationship between Plants and Humans?

- Humans and the plants/animals that they domesticated evolved a **symbiotic relationship.**
- This implies that humans and plants have become mutually interdependent for their existence on earth.
- The human-Plant symbiosis has become viable over the centuries because plant selection provides humans with plants that most satisfy their needs, whereas plant propagation multiplies those plants and preserves their essential genetic characteristics.

Plant Selection vs. Plant Propagation.

- **Plant selection provides** the plants that are most useful in promoting man's well-being. Selection is usually for desirable traits such as size, taste, ease of harvesting, storage quality, and processing into food or fiber products. Examples include wheat for bread, barley and hop for beer, cotton and kenaf for fiber, etc.
- **Plant propagation,** on the other hand, multiplies those plants and preserves their essential genetic characteristics. Examples include the use of vegetative propagation techniques to preserve the true-to-type characteristics of clones and certain cultivars.
- The development of plant propagation was a central event in human history and might have accounted for the transition between hunting and gathering and probably the origin of human society structure that we witness today (i.e., cities and nation states).

b Domestication

- The number of plant species in the world is infinitely abundant, yet only a few species are domesticated and used for food.
- The most likely reasons for this situation include:

  i. The need for plant domestication is determined by- **a) their usefulness**, **b) the ease with which they can be propagated, c) the limitations imposed by climatic factors**.

ii. The Neolithic or agricultural revolution was a slow and partial process, which occurred at different times and speeds in different parts of the world and was never complete.

- This was largely because the distribution and characteristics of plant species was determined largely by the environment, both the physical world (climate, soil, and topography), and biological interactions of plants, animals and humans.
- Example: the arid zones were the home of mobile pastoralists, who domesticated sheep and horses, and colonized the grazing lands of the steppes. Conversely, the densely forested areas in northern Europe and elsewhere were inhabited by hunters.
- Following the spread of agriculture, a differentiated (specialized) world economy emerged with well-defined zones. Cereal and root crop cultivation are characteristics of temperate and tropical regions, respectively.
- The most important food crops were seed plants (cereals, wheat, barley, rice, maize, millet, sorghum), which provided carbohydrates, and legumes (beans and peas), which are sources of plant protein.

Plant Breeding vs. Plant Propagation.

I. **Plant breeding** introduces genetic variation to increase the possibility of creating new and improved plant cultivars.

II. **Plant propagation** is the reciprocal of plant breeding. It strives to control genetic variation, to maintain the genetic potential of any particular cultivar (i.e., to prevent change in genetic potential during production).

The Segregation of Plant Husbandry into Different Areas of Specialization.

- By the **medieval period**, the practices of **agronomy, horticulture and forestry** became separate activities.
- Contributing factors during this time might have included the fact that:
  a) Societies were developing into organized units around estates, manor houses and castles with landlords providing protection. Under this system, it became beneficial to set aside large areas of forest as game reserves.
  b) Also, during this period, monasteries acted as independent and industrial organizations and preserved written and unwritten knowledge.

within both institutions, a separation developed among those involved in the production of cereals, fibers, and forage crops grown extensively in large fields (agronomy), vegetables, fruits, herbs, and flowers grown in 'kitchen gardens' and orchards near the home (horticulture), and woody plants grown for lumber, fuel and game reserves (forestry).

4. Organization of Human Societies

a. Ancient (7000 BC)

- Initial phase of domestication (plant selection, plant propagation, crop production)
- Increase in food supply and division of labor began to occur.
- Early Chinese writing indication knowledge of grafting, layering, and other techniques, rice and millet were the principal food sources.
- Americans, seed propagated crops (maize, beans, cucurbits, and squash) as well vegetatively propagated crops (potato, cassava, sweet potato, and pineapple) were developed and grown.

b. Greek and Roman (500 BC to AD 1000)

- Propagation techniques
- Control of land & agricultural surplus was the key power and wealth
- Olive oil and wine were exported, and grains were imported
- Romans developed ornamental gardens to a high level.

c. Medieval Period

I. Why were trade secrets important in plant propagation during the medieval era?

II. How do trade secrets apply to today's nursery business?

- Throughout the medieval period at the beginning of the modern European economy, specific skills and knowledge of plant propagation were possessed by few and specific individuals.
- These skills considered as **'trade secrets',** were passed from father to son or to specific individuals. Often this knowledge was accompanied by superstition and sometimes attained religious significance.

Note: *'trade secrets; were used to retain or gain competitive advantage in many professional fields and are still being used in today's business world.*

5. Exploration, Science, and Learning

a. Plant Exchange

- One major aspect of human development was plant material exchange.
- Exchange of plant material from the area of origin to other countries of the world.
- Early movement of useful plants involved military expansion into different countries of the world.
- Linnaeus established the binomial system of nomenclature and botanist began to catalog plants of the world.

- **A Wardian case (Fig.3 Page 7)** was developed (1800s) to help preserve material on long expeditions.

b. Morrill Act

- An act of congress in1862 that established land-grant universities for scientific study and teaching of agriculture and mechanical arts.
- Departments of agronomy, horticulture, and forestry were established.

6. The Development of the modern nursery

Why did modern nursery develop?

- The 'modern' nursery probably developed from the need to extend the length of the growing season in regions with cold winters. Thus, growing vegetables and flowering in protected structures (cold frames, hot beds) and later transplanting them to the field was an important part of production.
- The concept of the nursery as a place where plants are propagated for subsequent transplanting to their permanent site has been a part of plant husbandry since the beginning of agriculture.
- Several nurseries emerged in France during the 16^{th} and 17^{th} centuries, and subsequently throughout Europe.

Early plant breeding was often combined with nursery production practices-e.g., Victor Lemoine (1850).

7. The modern plant propagation industry and the Attributes of the plant

I. The modern plant propagation industry is complex: involving

a. The group that multiplies for sale and distribution, and
b. A large group of service industries such as transportation, nursery products sellers, regulatory agencies, consultants, research, extension and teaching services.

II. **The Plant propagator attributes:**

a) possess the knowledge and skills either to perform or to supervise the essential propagation tasks of specific plants,

b) understand the principles of plant growth and development,

c) knows different kinds of plants and have knowledge of their specific propagation requirements.

The knowledge and Skills required by a Plant Propagator.

I. The Art of Plant Propagation

- Technical skills for manipulating plant growth (how to take cuttings, perform budding, grafting, layering, and tissue culture procedures).

II. The principles (or science) of plant propagation.

- Requires knowledge and insight into plant growth and development, as well as morphology.
- The knowledge of physical, chemical, and physiological aspects of the environment, all acquired empirically by working with plants.
- This knowledge is best supplemented by formal study of chemistry, physics, botany, genetics, and plant physiology.

III. Knowledge of Plant Nomenclature and Plant Requirements.

- The most appropriate propagation method that ensures success is often related to the response of the plant species and the conditions under which propagation is being attempted.

8. Organizations and groups Involved in Plant Propagation

Study the information in Box 1 (page 13) in your textbook. The International Plant Propagators Society (IPPS), American Society for Horticultural Science (ASHS), International Society for Horticultural Science (ISHS), etc.

Reference

Fred T. Davies, Jr. Robert L. Geneve & Sandra B. Wilson 2018. Hartman & Kester's Plant Propagation Principles and Practices, 9th ed. Pearson New International Edition. **Pp.1-13**. ISBN-10:1-292-02088-1. ISBN-13: 978-0-13-448089-3

Hartmann HT, Kester DE, Geneve. 2014. Hartmann & Kester's Plant Propagation Principles and Practices, Upper Saddle River (Nueva Jersey, Estados Unidos). 8th ed.Pp. Nueva Jersey, Estados Unidos, US State: Prentice Hall; 2011:915